

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
TEXAS ANIMAL DAMAGE CONTROL PROGRAM

ENVIRONMENTAL ASSESSMENT
and
DECISION/FINDING OF NO SIGNIFICANT IMPACT
for
PREDATOR DAMAGE MANAGEMENT
in the
CANYON
ANIMAL DAMAGE CONTROL DISTRICT
TEXAS

INTRODUCTION

The U.S. Department of Agriculture (USDA) is authorized to protect American agriculture and other resources from damage associated with wildlife. The primary authority for the Animal Damage Control (ADC) program is the Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1468; 7 U.S.C. 426-426b and 426c) and the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988 (Public Law 100-202). ADC activities are conducted in cooperation with other federal, state, and local agencies, as well as private organizations and individuals. This Environmental Assessment (EA) analyzes the potential environmental impacts of a proposed action to continue the current predator damage management (PDM) program in the Canyon ADC District of the State of Texas.

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by wildlife (Leopold 1933, The Wildlife Society 1990, Berryman 1991). The ADC program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as "Integrated Pest Management" or IPM) in which a variety of methods may be used or recommended to prevent or reduce damage caused by wildlife. IWDM is described in Volume 4, Chapter 1, pages 1-7 of the ADC Final Environmental Impact Statement (FEIS) (USDA 1994). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that local populations of the offending species be reduced through lethal methods. The FEIS contains detailed discussions of potential environmental impacts from methods that are used for PDM in the District. The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) authorize agencies to eliminate repetitive discussions of issues addressed in programmatic Environmental Impact Statements by tiering to the broader documents (CFR 1500.4(I); 1502.20). Thus, this EA is tiered to the FEIS and incorporates relevant discussions and analyses from the FEIS. The FEIS may be obtained by contacting the USDA, Animal and Plant Health Inspection Service (APHIS), ADC Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

[REDACTED]

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PURPOSE AND NEED

The purpose of the proposed action within the Canyon District is to reduce or alleviate damage caused by predatory animals to livestock, wildlife, agriculture or other property, or which threaten public health or safety. Action is needed because various species of predators have caused damage to or threaten the above resources within the Canyon District, and federal and state laws have directed that efforts be made to resolve such problems.

Animal and Plant Health Inspection Service (APHIS) implementing regulations for NEPA allow for the categorical exclusion of PDM operations that are considered routine measures such as removals or control activities employed by agency programs to pursue their missions and functions (7 CFR, § 372.5 © 60 Fed. Reg. 6,000, 6,003 (1995)).

Nevertheless, this EA has been completed to adequately evaluate potential or cumulative impacts of planned future predator damage management operations by ADC within the Canyon District. The species of animals that have caused damages included within the scope of this EA include: coyotes (*Canis latrans*); feral dogs (*Canis familiaris*); red fox (*Vulpes vulpes*); gray fox (*Urocyon cinereoargenteus*); feral hogs (*Sus scrofa*); bobcats (*Lynx rufus*); and raccoons (*Procyon lotor*).

BACKGROUND

Texas is a leading contributor of cattle, sheep and Angora goat production in the United States. The Texas agricultural community published livestock inventory and production estimates showing 15,000,000 head of cattle and calves, 1,650,000 head of sheep and lambs, 1,900,000 head of goats (mostly Angora and Spanish) in the State as of January 1, 1996 (TASS 1996).

Texas environs support a wide ranging and diverse spectrum of habitat types and wildlife. Included in this diversity is a variety of predator species. Conflicts between predators and humans arise only when their predatory nature turns toward agricultural resources or otherwise threatens public safety. A positive correlation between predator concentrations and livestock losses due to predation has been fully documented (Nunley 1995a, Shelton and Klindt 1974, Pearson and Caroline 1981). When predator concentrations increase, predation loss is a major factor in sheep and goat production. The Texas Agricultural Statistics Service (TASS 1996) reported that predation was a leading cause of death among sheep and goats in the [REDACTED]. Sheep and lamb predation losses in Texas exceeded \$2 million in 1994 (NASS 1995). These losses represent direct costs to the producer (e.g., value of the animal and its wool or mohair) and indirect costs such as additional costs of production, loss of rangeland utilization or unsuitability of areas due to predator concentrations, and foregone monetary gains. Predation has been a common factor in sheep and goat production failures.

The Canyon District includes 61 counties in the panhandle of Texas covering approximately 37.8 million acres of land (about 28.7% of the State) (Figure 1). The District is comprised mostly of the High Plains and Rolling Plains ecological regions of Texas, and includes a small portion of the [REDACTED]. Much of the primary economic and cultural interests within the District are agricultural in nature, dominated by sheep, goat, and cattle production. Estimates indicate the presence of more than five million head of livestock in the District with an economic value of more than \$2 billion (TASS 1996).

Losses to the livestock industry within the District have been extensive even with the presence of ongoing control measures. The value of livestock losses to predators (specifically coyotes, feral dogs, red fox, gray fox, feral hogs, bobcats, and raccoons) reported to ADC by cooperating producers within the District totaled more than \$248,000 in 1993 (the latest year for which comprehensive cooperator interview data are available). ADC personnel confirm a portion of these losses each year. In Fiscal Year 1995, verified predation losses in the District totaled \$39,564. These losses represent only those reported to or confirmed by the [REDACTED] and do not include losses experienced by producers that do not participate in the program. Based on studies of loss rates with and without PDM, the ADC FEIS determined that loss rates of lambs and sheep would average about 17% and 4.5%, respectively, in the absence of PDM (USDA 1994). It can reasonably be assumed that these or greater loss rates of kid and adult goats would also occur without PDM. No studies of cattle and calf losses in the absence of PDM have been conducted.

However, survey data discussed in USDI (1978) showed that 85% of cattle producers in the southwest U.S. had no losses of calves to coyotes, that 13% had coyote predation losses of up to 5% of calves born alive, and that 2% had losses to coyotes greater than 5%. Those data indicate a minority of cattle producers have most of the coyote predation problems experienced by cattle producers as a whole. It is within reason to assume that producers who experience higher losses are more likely to become ADC cooperators; thus, it is reasonable to predict that, without effective PDM, losses on cooperating cattle ranches would be as great as the higher loss producers in the data shown by USDI (1978). Therefore, we predict that cooperating cattle ranches would have an average of around 5% calf losses to coyotes in the absence of PDM. Under the above assumptions and based on the numbers and value of these livestock classes protected by ADC in 1993 (the last year for which such data are available), predation losses on cooperating ranches could have been more than \$1.4 million in the District without effective PDM.

The health and safety of humans and livestock have been threatened in Texas since 1991 with the eruption of two rabies epizootic outbreaks involving coyotes and gray fox (Clark and Wilson 1995). In these outbreaks, two human deaths have been documented with more than 4,000 rabies post-exposure treatments being administered. Hundreds of confirmed cases of rabies in livestock have also been documented by the Texas Department of Health (TDH) during that same period (Fearneyhough 1996, pers. comm.). In the District, gray fox rabies has been prevalent in three of the 61 counties and the [REDACTED] is being asked to reduce gray fox numbers in certain high risk areas and to assist in monitoring rabies or other wildlife-borne diseases by providing specimens or biological samples to the TDH.

ISSUES AND PUBLIC INVOLVEMENT

Issues are concerns of the public and/or of professional communities about potential environmental problems that might occur from a proposed federal action. Such issues must be considered in the NEPA decision process. Issues relating to the management of predator damage were raised during the scoping process in preparing the programmatic ADC FEIS (USDA 1994) and were considered in the preparation of this EA. These issues are fully evaluated within the FEIS, which enumerates specific data relating to the [REDACTED].

The following issues were determined to be relevant to PDM in the District:

1. Effects on Target Predator Species Populations
2. Effects on Nontarget Species Populations, including Threatened and Endangered (T&E) Species.
3. Effects of Target Species Removal on Prey Populations
4. Effects on Public Safety
5. Effects on Hunting
6. Humaneness

Potential environmental impacts of the Proposed Action and Alternatives in relation to these issues are discussed in the Environmental Consequences section. All issues except 3 and 5 were addressed in detail in the FEIS. As part of this process, and as required by the CEQ and APHIS NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOAs) published in local media and through direct mailings of NOAs to known potentially affected or interested parties. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Effects on Historic or Cultural Resources. The National Historical Preservation Act (NHPA) of 1966 as amended and its implementing regulations (36 CFR 800) require federal agencies to: 1) determine whether activities they propose constitute “undertakings” that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Activities described under the proposed action do not cause major ground disturbance or other effects on historic or cultural resources and are thus not undertakings as defined by the NHPA.

METHODS AND ALTERNATIVES INCLUDING THE PROPOSED ACTION

The Methods Considered section summarizes the best technology that has evolved from continued development and refinement by research and the experience of professional wildlife biologists. Examples of specific control technologies that may be utilized or recommended to cooperators under each Method Considered are provided. The Alternatives Considered were developed from five different management strategies. The Proposed Action Alternative was selected as the preferred alternative based on the ability of that strategy to efficiently and effectively address and resolve the human/wildlife conflicts identified in this EA.

Methods Considered:

1. Exclosure. Modified fencing design could limit the entry of predators into pastures or pens.
2. Harassment. The use of harassment techniques such as the electronic guard, guard dogs or other guarding animals, sirens, horns, and propane exploders could be used to temporarily move or repel problem predators from areas where damage is occurring or expected.
3. Animal Husbandry. Modification in the level of care and attention given to livestock, (i.e., shed lambing, night penning) during periods of highest predator activity. Generally, as the frequency and intensity of livestock handling increases, so does the degree of protection.
4. Lethal Removal of Offending Individual Animals or Localized Population Reduction. Lethal control methods would be used selectively to remove predators that are preying upon or threaten livestock, are creating hazards to public safety, or are damaging crops or property. Lethal population reduction techniques could include the use of leghold and cage traps, foot snares, neck snares, shooting, trail and decoy dogs, aerial hunting, M-44 devices (to take wild canids suspected of preying on livestock), and Livestock Protection Collars (for coyote predation on sheep or goats only). For a description of these methods the reader is referred to the FEIS, Appendix J. A formal risk assessment of all mechanical and chemical methods used by the ADC PDM program in the District is in the FEIS, Appendix P.

Alternatives Considered:

1. No Federal ADC PDM.

This Alternative would preclude any management activity by the federal ADC program to prevent or alleviate damage or threats of damage by predators in the Canyon District. It would not limit PDM activities by private individuals or by the remaining [REDACTED].

This action is not identified as the preferred alternative because it would not allow for the most effective resolution of the adverse human-wildlife interactions or public health threats. This action would also not allow ADC to meet the intent of its enabling federal legislation that directs the ADC program to address

such problems. This Alternative is analyzed and discussed as the “No Action” alternative in the programmatic ADC FEIS (USDA 1994).

2. Current ADC PDM Program Using Integrated Wildlife Damage Management (Preferred Alternative)
(This is the same as the Current Program Alternative analyzed in the FEIS).

This Alternative would allow ADC to continue the current PDM program in the District. The current program uses the Integrated Wildlife Damage Management (IWDM) approach which is the integration and application of practical methods of prevention and control to reduce damage by wildlife while minimizing harmful effects of control measures on humans, other species, and the environment. This Alternative would utilize or recommend any combination of the methods identified in the "Methods Considered" section to resolve predator damage problems. Nonlethal and lethal control methods would be used as appropriate. The IWDM approach as employed by ADC under Alternative 2 considers nonlethal methods in the formulation of each control strategy and gives preference to nonlethal use when judged practical and effective. Coordinating control efforts in this way would provide the flexibility so as to have the least impact on the environment by allowing nonlethal techniques to be utilized to their greatest potential and by not needlessly restricting the use of lethal methods where they are the most practical, but still environmentally acceptable, methods for resolving a problem. The steps involved in formulating this integrated management process are listed in detail in Volume 2, Chapter 2, pages 15-37 of the ADC FEIS (USDA 1994). The evaluation process would consider the nature and magnitude of damage, the ability of the resource to sustain further damage, biological and economic considerations, and other pertinent factors. This evaluation process would be conducted in accordance with the ADC Decision Model as described in the ADC FEIS, Chapter 2, Section D2b (USDA 1994). The ADC Decision Model is the routine thought process that is the site-specific procedure for determining methods and strategies to use or recommend for individual PDM actions addressed by ADC in the District (see the ADC FEIS, Appendix N for more examples of the Model's application). This Alternative was analyzed and discussed in the programmatic ADC FEIS (USDA 1994).

3. Nonlethal PDM Only.

Under this alternative, only nonlethal techniques would be implemented by ADC to prevent or alleviate damage or threats caused by predators. If damage caused by predators continued despite use of nonlethal controls, management actions would be limited to continuing the same or other nonlethal type of strategy or to take no action. Although many nonlethal techniques are applicable and might be adequate to effectively reduce damage in some situations, they are not adequate to address all damage caused by wildlife (USDA 1994) and would, therefore, allow the damage to continue and possibly increase in many situations. It has been shown that the exclusive use of nonlethal techniques provides, at best, only short-term damage reduction (Bomford and O'Brian 1990).

Some nonlethal methods can adversely affect nontarget wildlife. Guard dogs sometimes kill deer fawns and can adversely affect turkey distribution (Timm and Schmidt 1989). Predator-proof fences can restrict movements of deer and other wildlife to the point that they cannot reach all available forage and water resources (Wade 1982). This can effectively reduce the carrying capacity of certain habitat areas for such species, resulting in population decline.

Alternative 3 would not adequately address predation losses or hazards to public safety and is, therefore, not the preferred alternative. This Alternative is further analyzed and discussed in the programmatic ADC FEIS (USDA 1994).

4. Require Nonlethal Management be Attempted Prior to Lethal Management.

This Alternative would exhaust all available nonlethal control methods prior to using any lethal control methods. The important distinction between this Alternative and Alternative #2 (Integrated Wildlife Damage Management) is that this Alternative would require that all nonlethal methods be used before any lethal methods are used.

Although this Alternative would allow for the implementation of all available control techniques, it would limit effectiveness and increase costs by requiring that nonlethal control techniques be exhausted before the use of any lethal techniques, whether they have been proven effective or not. This Alternative would not allow for the adequate resolution of adverse human-wildlife interactions and is, therefore, not the preferred alternative. This Alternative is further analyzed and discussed in the programmatic ADC FEIS (USDA 1994).

5. Compensation Program for Predator Damage Losses.

This Alternative would require the establishment of a compensation program for reimbursing the value of losses caused by predators. Threats to public health and safety, including rabies suppression, would not be addressed under this Alternative. This Alternative was analyzed and discussed in the programmatic ADC FEIS (USDA 1994).

Federal and, potentially, state legislation making funding available for a compensation program would be required before this alternative could be implemented. Using the best information available, the ADC programmatic FEIS concluded that benefits, in terms of avoided sheep and lamb losses (not including avoided losses of calves, goats, or other livestock) plus price benefits to consumers, are 2.4 times the cost of providing ADC PDM services for sheep protection in the 16 western states (USDA 1994, pp. 4-109). Excluding price benefits to consumers, the value of avoided losses of sheep and lambs *only* was about 2.1 times the cost of service. Thus, funds for a compensation program would probably need to be more than twice the current funding level for PDM in the District to provide a reasonable level of compensation for livestock losses. Many livestock losses are not verifiable because they are never found or are too consumed or decomposed to confirm they were caused by predators. Compensation would therefore not be provided for many predation losses.

Additional alternatives that were considered but not analyzed in detail, but that are covered in more detail in the ADC programmatic FEIS, include:

6. Direct Control Only Program (No Technical Assistance)
7. Technical Assistance Only (No Direct Control)
8. Transfer Program to Cooperative Extension Service
9. Transfer Program to Private Contractors
10. Transfer Program to State Agencies
11. Continue Coyote Control, Transfer Other Activities to Fish and Wildlife Service
12. Eradication Program
13. Suppression Program

ENVIRONMENTAL CONSEQUENCES AND CUMULATIVE IMPACTS

The ADC program evaluated the environmental consequences and cumulative impacts of the above alternatives in the ADC programmatic FEIS (USDA 1994). In the development of the FEIS, issues concerning biological, economic, sociocultural, and physical impacts for these alternatives were identified and results are listed in Volume 2, Chapter 4, Table 4-42 of the FEIS.

Cumulative impacts, as defined by the CEQ (40 CFR 1508.7), are impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such other actions (USDA 1994).

All PDM activities implemented under the preferred alternative of this EA will be undertaken in compliance with all relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). All pesticide usage would be in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and with product labels, use restrictions, and ADC policy. ADC PDM will be in alignment with all applicable T&E species mitigation procedures identified in the U.S. Fish and Wildlife Service (USFWS) Section 7 (ESA) Biological Opinion (BO) signed July 28, 1992 (USDA 1994), as well as any further mitigation measures established as a result of additional Section 7 consultations.

The following section analyzes the cumulative impacts of the current program of PDM by the [REDACTED] in the District in relation to the issues identified herein:

Effects on Target Species Populations

Coyote Population Impact Analysis

To discuss the impacts of various environmental constraints and external factors on coyote populations and density, it is essential to understand the basic mechanisms that play a role in the coyotes' response to constraints and actions. The species' unique resilience, adaptability and its perseverance under adverse conditions is commonly recognized among biologists and rangeland managers.

Coyotes are highly mobile animals with home ranges (territory) that vary by sex and age of the animal and season of the year (Pyrah 1984, Althoff 1978, Todd and Keith 1976). Normal litter size is from two to 12, averaging about six after a gestation period of approximately 63 days (Schmidly 1988). Coyote population densities will vary depending on the time of year, food abundance, and habitat. Coyote densities have ranged from a low of 0.39/mi² during the time when populations are low (just prior to the annual period of pup birth) to a high of 3.55/mi² when populations are high (just after the period of pup birth) (Pyrah 1984, Knowlton 1972). Coyote home ranges may vary from 2.0 mi² to 21.3 mi² (Andelt and Gipson 1979, Gese et al. 1988). Ozoga and Harger (1966), Edwards (1975), and Danner (1976), however, observed a wide overlap between coyote home range and did not consider coyotes to be territorial. Each occupied coyote territory may have several nonbreeding helpers at the den during whelping (Allen et al. 1987, Bekoff and Wells 1982). Therefore, each defended coyote territory may have more than just a pair of coyotes. Messier and Barrette (1982) reported that 35% of the coyotes were in groups of three to five animals from November through April. Gese et al. (1988) reported that coyote groups numbering two, three, four and five comprised 40%, 37%, 10% and 6% of the resident population, respectively. The presence of unusual food concentrations and presence of nonbreeding helpers at the den can influence coyote densities, complicating efforts to estimate abundance (Danner and Smith 1980).

Coyote population densities have been estimated in the western states to be an average of 0.5 to 1.0/mi² (Pyrah 1984, Camenzind 1978, Knowlton 1972, Clark 1972, USDI 1979). Coyote densities for Texas are estimated to range from 246.2 - 278.3 acres per animal (2.3 - 2.6 coyotes/mi²) in South Texas and 640 acres per animal (1.0/mi²) in the Trans Pecos area of the State (TPWD 1993). Field surveys by the Texas Parks and Wildlife Department (TPWD) indicate coyote densities in the Rolling Plains region, which is the habitat type of about 50% of the District, are the highest in the State (TPWD 1993) which suggests they exceed the 2.3/mi² that occur in South Texas. Data were insufficient to reach conclusions about coyote densities in the High Plains region that

comprises the other 50% of the District. However, observations by ADC personnel indicate densities in that habitat type are at least half the densities in the Rolling Plains region. Population estimates made by field observations, when based on experience, knowledge of the species being estimated, and intuition, may provide estimates as accurate as those based on more scientific methods (Fritzell 1987). Thus, it is reasonable to conclude that coyote densities conservatively average at least 1.0 coyote/mi² in 50% of the District and at least 2.3/mi² in the other 50% of the District, which indicates a population of more than 90,000 coyotes.

To determine cumulative effects of coyote control, data records on the number of coyotes taken by [REDACTED] in the District were compared with fur harvest records from the Texas Parks & Wildlife Department (TPWD). Data on the [REDACTED] coyote take in the District are available for Fiscal Year 1995. Fur harvest data are available for the 1994-95 fur harvest season from the TPWD, but these figures cover the whole State and are not broken down by ecological regions or districts. Therefore, it is assumed that private harvest was approximately uniform across the State. Within the State, the total known take of coyotes from private harvest activities was 20,725 in FY 1995. The Canyon District is about 28.7% of the State; thus, private coyote take in the District is estimated to have been about 5,950 during FY 1995. The total [REDACTED] take of coyotes in the District for FY 1995 was 4,797 coyotes, which represents about 5% of the estimated population within this District. The cumulative take from fur harvest and ADC activity within the District is estimated to be 10,747 animals, which is about 12% of the estimated population.

Connolly and Longhurst (1975) determined that an annual population reduction of 75% would have to be maintained for 50 years to cause a coyote population to be eliminated. Their model suggests that an annual reduction of 70% would be sustainable due to compensatory reproduction. To further demonstrate the coyote's recruitment (reproduction and immigration) ability, if 75% control occurred for 20 years, coyote populations would regain precontrol densities by the end of the fifth year after control was terminated. Furthermore, immigration, not considered in the Connolly/Longhurst model, can result in rapid occupancy of vacant territories (Windberg and Knowlton 1988). While removing animals from localized areas at the appropriate time can protect vulnerable livestock, immigration of coyotes from the surrounding area could quickly replace the animals removed (Stoddart 1984). Connolly (1978) noted the coyote has survived, and even thrived, in spite of early century efforts to exterminate it. Evaluating the data using standards established in USDA (1994) to determine the magnitude to which total harvest impacts the species, a cumulative harvest of less than 75% of the sustainable harvest level of 70% of the population of coyotes results in a determination of "low magnitude." Thus, a "low magnitude" impact rating is achieved if no more than 53% of the population is taken per year. Based on this information, [REDACTED] PDM activities in the District will have no significant adverse cumulative impacts on the overall coyote population in the District. In areas of private land where localized populations are kept low by PDM activities, this is part of the status quo for the human environment and thus is not a significant adverse impact on the human environment in those areas.

Red Fox and Gray Fox Population Impact Analysis

Red fox and gray fox inhabit brushy and wooded areas. While gray fox are found mostly throughout the State, red fox are generally found within the central and eastern part of the State. Both have omnivorous feeding habits, consisting mostly of birds, rabbits, eggs, insects, carrion, fleshy fruits, and grains, and both have been documented preying upon livestock. Both species reach reproductive maturity at about one year of age and litters average four pups after a 63 day gestation period (Schmidly 1988). Published estimates of population densities in Texas range between 31.2 - 206 acres per animal (3.1 - 20.5/mi²) for gray fox and 246.1 - 2,133 acres per animal (0.3 - 2.6/mi²) for red fox (TPWD 1993). Using the low end of these density ranges to be conservative, populations of these species in the District are estimated to be a minimum of about 180,000 and 18,000 for gray fox and red fox, respectively.

Private fur harvest in the State totaled 8,066 gray fox and 1,857 red fox in the 1994-95 fur harvest season (TPWD 1996). [REDACTED] take of gray fox and red fox in the District during FY 1995 was minor and totaled 22 and 11 animals, respectively. Gray fox take and red fox take by the [REDACTED],

respectively, of the populations. Assuming that private harvest was uniform throughout the State, the cumulative take of gray fox in the District would be 2,400 animals or 1.3% of the District population, and cumulative take of red fox in the District would be 533 or 3.0% of the District population.

The sustainable harvest level for gray and red fox determined in USDA (1994) is 25% and 70%, respectively, of a given population of each species. Even under the conservative assumptions contained in this analysis, cumulative take in the District is currently well below the sustainable harvest level and is expected to remain so. Thus, the cumulative impact upon gray fox and red fox populations from [REDACTED] PDM program is determined to be of "low magnitude" and adverse impacts on these populations are expected to be insignificant.

Bobcat Population Impact Analysis

Bobcats may reach reproductive maturity at approximately nine to 12 months of age, but females do not breed during their first year. Litter sizes range from one to five and are born following a gestation period of about 62 days (Schmidly 1988). Annual population estimates are not maintained by TPWD. However, based on deer spotlight surveys, bobcat population trends appear to be stable or slightly increasing throughout the State (TPWD 1993).

Private fur harvest in the State totaled 6,275 bobcats in the 1994-95 fur harvest season. This figure is substantially lower than the 13,000 to 27,000 bobcats that were regularly taken each year during the 1980's (TPWD 1996). [REDACTED] total take of bobcats in the State was 1,645 animals in FY 1994 and 1,527 in FY 1995. Statewide cumulative take from all known causes was 7,802 animals in FY 1995. ADC take in the District was 62 in FY 1995. Assuming a uniform harvest of bobcats throughout the State, private harvest in the District was about 1,800 during FY 1995, which makes cumulative take about 1,900 in FY 1995. ADC's take was therefore about 3% of the total take.

The sustainable harvest level for bobcats in the USDA (1994) was established at 20% of a given total population which is close to the allowable harvest level of 19% indicated by the TPWD (1996). The TPWD determined a maximum allowable harvest for bobcats in the State to be 26,902 (TPWD 1996). That level of harvest has only been exceeded once since the 1979-80 season (27,031 in 1987-88), and since 1990, annual private harvest has not exceeded 6,275 (TPWD 1996). Combined with ADC take, the cumulative harvest (7,802) in FY 1995 was less than one-third of the allowable harvest level determined by TPWD. At these take levels, the cumulative impact on bobcat numbers in the District is expected to remain of low magnitude which means there would be no significant adverse impacts on the bobcat population under the current program.

Raccoon Population Impact Analysis

The raccoon is recognized by the TPWD as the most abundant and widely distributed of all furbearers. Population densities of raccoons in the Rolling Plains ecological region (which is about 50% of the District) are reported to be about 15 acres per animal (43/mi²) (TPWD 1993). Data were insufficient to make a determination of densities in the High Plains region that comprises the other half of the District. Nevertheless, this would indicate a population estimate of at least 1.2 million raccoons in the Canyon District. The total take of raccoons in the District by [REDACTED] in FY 1995 was 102 animals, or less than 0.008% of the population. Annual private harvest of raccoons statewide has ranged from a low of 48,077 in 1990-91 to as high as 465,145 in 1979-80 (TPWD 1996). Assuming private harvest in the District occurred proportionally, the range for the District was from 14,000 to 133,000 per year. ADC's take was only in the range of 0.08 - 0.7% of total take. Estimated cumulative take of raccoons by [REDACTED] and private fur harvest within this area of the State is only 1.2 to 11% of the conservatively estimated population of raccoons within the District.

A sustainable harvest rate for raccoons in the USDA (1994) was established at 49% of a given population. The cumulative take level shown above is less than 1/4 of this level. Thus, the magnitude of impact on raccoon

populations from [REDACTED] PDM actions is determined to be of “low magnitude” and adverse impacts on the population are expected to remain insignificant.

Feral Hog and Feral Dog Impact Analysis

Feral hogs are a nonindigenous species in the State. They are relatively prolific reproducers, having as many as two litters per year, with each litter consisting of four to ten young (Stevens 1996). The statewide population of feral hogs is reported to be one million (Taylor 1993). Feral hogs are found over a large portion of the State. Rollins (1993) indicated they may be found in 185 counties. Predation problems by feral hogs have been primarily limited to areas in the State with high kid goat and lamb production.

Feral dogs are free-ranging “wild” domesticated dogs that will commonly pack together and can cause significant losses to livestock producers. They are provided no protection by federal or state laws. Take of feral and/or free-ranging dogs by the program is considered to be of no significant impact on the human environment since dogs are not an indigenous component of ecosystems in the State and can have negative impacts on native wildlife species. The kill of dogs by ADC is minor in comparison to the number killed by animal control and humane organizations in the country each year.

In FY 1995, 459 feral hogs were taken by ADC in the District, which was about 0.05% of the total statewide estimated population. A total of seven feral dogs were taken in the District in FY 1995.

Because feral hogs and feral dogs are nonindigenous and often destructive to agricultural interests and native wildlife, and they compete with native wildlife for habitat, many individuals consider the complete eradication of the feral hog and feral dog necessary and beneficial to the environment. On the other hand, some landowners value feral hogs as game animals and many receive income from selling hunting rights for sport harvest of the species (Rollins 1993). Taylor (1991) states “the feral hog has managed to survive, adapt, and increase its numbers despite attempts at population control. . . . While it is possible to keep the population in check with continuous control, it is highly unlikely to eradicate a hog population within an established range.” The [REDACTED] only removes feral hogs from properties where the landowners or lessees have authorized such removals. Therefore, any level of take by [REDACTED] of feral hogs or feral dogs would be considered as having no significant adverse impact on the human environment.

Effects on Nontarget Species Populations Including T&E Species

All nontarget species taken in the District are either nonnative (e.g., feral/free-ranging) or are common and not classified as threatened or endangered under either state or federal law and are taken in low enough numbers (<20 per year of each species) that population impacts analysis is unnecessary. As stated previously, removal of feral and/or free-ranging dogs and feral hogs is considered environmentally beneficial because these species are not part of the mix of native wildlife in the District and can themselves have adverse impacts on native wildlife.

Threatened and Endangered Species

Federally listed T&E species in Texas include five species of mammals, 14 birds, six reptiles (five sea turtles and the Concho water snake (*Nerodia paucimaculata*)), three amphibians (two salamanders and one toad), seven invertebrates, and 27 species of plants. In making “may effect” determinations for ADC methods in the 1992 BO, the USFWS made no such determinations for any listed fish, invertebrate, or plant species. Therefore, ADC has determined its PDM methods will not affect any listed fish, invertebrate, or plant species that may occur in the District. In addition, ADC methods would have no effect on the three amphibian species or on any of the five species of sea turtles. ADC’s PDM methods have no potential to take the Concho water snake and ADC’s PDM activities do not result in habitat alteration that could adversely impact this species. Because of these factors and the limited range and habitat preference of the Concho water snake, ADC has determined its PDM actions will have no effect on this species.

Listed mammal species include one bat species, the Louisiana Black Bear (*Ursus americanus luteolus*), the West Indian manatee (*Trichechus manatus*), jaguarundi (*Felis yagouaroundi cacomitli*), and ocelot (*Felis pardalis*). The 1992 BO determined ADC actions would not affect any listed bat species, and none of the other mammal species occur in the District.

ADC has requested formal consultation under section 7 of the ESA to address potential impacts on the Mexican Spotted Owl (*Strix occidentalis*) and southwestern willow flycatcher (*Empidonax traillii extimus*) and will abide by any Reasonable and Prudent Alternatives that result from that consultation. Of the other listed bird species, the only one potentially affected by ADC PDM activities is the bald eagle (*Haliaeetus leucocephalus*) which was covered by the 1992 BO. ADC follows reasonable and prudent alternatives and measures and abides by terms and conditions established in the 1992 BO to avoid adverse impacts to the bald eagle and other listed species (see Appendix F of the FEIS).

ADC has not taken any T&E species in the District, and it is expected such take would continue to be avoided under the current program.

Effects of Target Species Removal on Prey Populations

The relationship between predators and rodent and rabbit populations have been summarized in USDI (1979).

Rabbit and rodent populations normally fluctuate substantially in several-year cycles. Two hypotheses attempt to explain these cyclic fluctuations: 1) rodent and rabbit populations are self-regulated through behavior, changes in reproductive capacity due to stress, or genetic changes (Chitty 1967, Myers and Krebs 1971), 2) populations are regulated by environmental factors such as food and predation (Pitelka 1957, Fuller 1969).

Keith (1974) concluded that: 1) during cyclic declines in prey populations, predation has a depressive effect and as a result, the prey populations may decline further and be held for some time at relatively low densities, 2) prey populations may escape this low point when predator populations decrease in response to low prey populations, and 3) since rabbit and rodent populations increase at a faster rate than predator populations, factors other than predation must initiate the decline in populations.

Wagner and Stoddart (1972) and Clark (1972) independently studied the relationship between coyote and black-tailed jackrabbit (*Lepus californicus*) populations in northern Utah and southern Idaho. Both concluded that coyote populations seemed to respond to an abundance of jackrabbits. When a broad range of prey species is available, coyotes will generally feed on all species available; therefore coyote populations may not vary with changes in the availability of a single prey species (Knowlton 1964, Clark 1972).

The impact analysis on rodents and lagomorphs (rabbits and hares) showed that predators generally prolong the low points in rodent population cycles and spread the duration of the peaks. Predators generally do not "control" rodent populations (Keith 1974, Clark 1972, Wagner and Stoddart 1972). It is more likely that prey abundance controls predator populations. The USDI (1979, p. 128) concluded that "ADC Program activities have no adverse impacts to populations of rodents and lagomorphs." The USDA (1994) did not specifically deal with this issue.

Henke (1995) reviewed literature concerning coyote-prey interactions and concluded that short term (\leq six months) coyote removal efforts typically do not result in increases in small mammal prey species populations, but that longer term intensive coyote removal (nine months or longer) can in some circumstances result in changes in rodent and rabbit species composition that may lead to changes in plant species composition and forage abundance. The latter conclusion was based on one study (Henke 1992) which was conducted in the Rolling Plains area of Texas that involved one year of pretreatment and two years of treatment. Whether such changes would occur in all

ecosystems in general remains to be proven. Nevertheless, most PDM actions in the District are not year round but occur for short periods after damage occurs (corrective control situations) or for short periods (90-120 days) at the time of year when benefits are most likely such as the period of time immediately preceding calving or lambing in the spring. This factor, combined with the fact that ADC conducts PDM on less than 6% of the land area of the District and kills a low percentage (< 6%) of the District population of coyotes in any one year means ecosystem impacts from ADC actions should be low in magnitude. On certain areas of historic sheep and goat production within the District, the historic *status quo* for many years prior to the passage of NEPA was an ecosystem with few or no coyotes (Nunley 1995b). Any ecosystem changes from historic coyote removal, if they occur, is therefore part of that *status quo* and an accepted part of the human environment by the landowners or managers. Also, take of other carnivores that prey on rodents and rabbits is too low to indicate any potential for a significant effect. Evidence also exists to suggest other carnivores such as badgers (*Taxidea taxus*), bobcats, and foxes increase in number when coyote populations are reduced (Robinson 1961, Nunley 1977). Therefore, even if coyote numbers were reduced substantially in a localized area, other species that prey on rodents and rabbits would probably increase in number to naturally mitigate a reduction in coyote predation on those prey species.

Effects on Public Safety

A formal risk assessment of ADC methods, including those used for PDM in the District, concluded low risks to humans (USDA 1994, Appendix P). Therefore, no adverse impacts to public safety are expected from ADC PDM activities in the District. If PDM for human health and safety is requested (e.g., rabies suppression), then ADC PDM would have beneficial effects on public safety.

Beneficial impacts to human health and safety are expected from the ability of the current program to assist in reducing the threat of rabies and other wildlife-borne disease problems. Such assistance can be in the form of performing local population reductions of certain predator species at the request of TDH, or in providing biological samples for purposes of monitoring or detecting wildlife-borne diseases.

Effects on Hunting

Some sport hunters might feel that ADC PDM activities conflict with certain sport hunting pursuits, particularly those that involve private sport take of coyotes, bobcats, gray and red fox, and feral hogs. ADC only conducts PDM on private properties in the District for which signed *Agreements for Control* are obtained from the landowner, lessee, or administrator. Thus, there is no potential for ADC PDM to conflict with sport hunting or trapping interests on properties owned or controlled by persons who place more value on such interests than in damage management.

Considerable evidence exists to show that coyotes can have significant impacts on survival of white-tailed deer fawns (Teer et al.1991; Beasom 1974), and that coyote control can improve fawn survival substantially (Guthery and Beasom 1977). Thus, on some areas on which ADC conducts PDM, deer hunting opportunities might improve if predation was a limiting factor in deer recruitment and abundance. In such situations, PDM could have a beneficial impact on sport hunting for deer.

Humaneness

The ADC FEIS addressed the issue of humaneness. Two aspects of humaneness exist with regard to PDM (1) the suffering of wild animals captured and/or killed to stop or reduce damage or threats, and (2) the suffering of livestock killed or injured by predators. Many organizations including environmental and animal welfare organizations are concerned that some methods used by ADC are inhumane. Livestock producers are concerned about the pain and suffering of livestock killed or injured by predators. It has been argued that man has a moral obligation to protect these animals from predators (USDA 1994). Predators frequently do not kill larger prey animals quickly, and will often begin feeding on them while they are still alive and conscious (Wade and Bowns

1982). The suffering apparently endured by livestock damaged in this way is unacceptable to many livestock producers.

The current program strives to achieve a balance between the two aspects of humaneness. Although current technological constraints mean practical and effective PDM often requires the use of lethal methods causing some animal suffering, overall animal suffering may actually be less because deaths and injuries to livestock are avoided. The ADC program has evolved toward the use of more selective techniques which means fewer nontarget animals are killed (USDA 1994). During FY 1995, only 6.5% of the animals killed by statewide ADC PDM activities were nontarget. These figures indicate that the program was more than 93% selective for targeted species. Without effective PDM by a government agency, the private sector experiencing damage might resort to methods of control that are less selective than ADC which could result in greater suffering of nontarget species.

The relative impacts of each alternative on each issue is presented in Table 1.

Table 1
Comparison of Alternatives by Issue

Issue	1. Effects on Target Predator Species Populations	2. Effects on Nontarget Species Populations including T&E Species
Alternative 1 No Federal PDM Program	PDM needs would be met by private individuals and state agencies. Take by private individuals would not be regulated or accounted for. Cumulative take of target species would likely decrease for a period until private and state PDM is compensated for loss of federal funds. Use of illegal toxicants would probably increase with possible increase in overall take of target species, but kills would likely not exceed sustainable take levels.	PDM needs would be met by private individuals and state agencies. Take of nontarget species would likely increase as private PDM increased using less selective methods including illegal toxicant use. Local populations of nontarget species could be reduced if sustainable take levels are exceeded. Kills of T&E species would be more likely and would not be accounted for.
Alternative 2 Current Federally Supervised PDM Program (using Integrated Wildlife Damage Management)	Cumulative take of target species populations would remain below levels sustainable by District populations, meaning adverse impacts would not be significant.	Selective PDM methods used by federally supervised ADC Specialists would continue to minimize nontarget take. Impacts on nontarget populations and T&E species would continue to be monitored and accounted for. T&E take would continue to be avoided or, if any occurred in the future, would most likely be within incidental take levels allowed by USFWS.
Alternative 3 Nonlethal PDM Only	Reduced effectiveness would cause local governments and individuals to drop out of federally supervised PDM programs. PDM needs would then be met by private individuals and state agencies, and adverse impacts on target species populations would be similar to Alternative 1.	Reduced effectiveness would cause local governments and individuals to drop out of federally supervised PDM programs. PDM needs would then be met by private individuals and state agencies, and adverse impacts on nontarget and T&E species populations would be similar to Alternative 1.

Alternative 4 Require Nonlethal Before Using Lethal PDM	Reduced effectiveness might cause local governments and individuals to drop out of federally supervised PDM programs (less likely than under Alternative 3). PDM needs would be met by private individuals and state agencies. Adverse impacts on target species populations would be similar to Alternative 1 but probably to a lesser degree.	Reduced effectiveness might cause local governments and individuals to drop out of federally supervised PDM programs (less likely than under Alternative 3). PDM needs would be met by private individuals and state agencies. Adverse impacts on nontarget and T&E species populations would be similar to Alternative 1 but probably to a lesser degree.
Alternative 5 Compensation Program	Congress would have to appropriate funds for compensation. Some current recipients of PDM would be satisfied with compensation, but a majority would not since many losses are not verifiable which would be a requirement of compensation. Dissatisfaction with compensation would lead private individuals and perhaps state agencies to increase PDM activities. Impacts on target species populations would be similar to Alternative 1 but probably to a lesser degree.	Dissatisfaction with compensation would lead private individuals and perhaps state agencies to increase PDM activities. Impacts on nontarget and T&E species populations would be similar to Alternative 1 but probably to a lesser degree.
Issue	3. Effects of Target Species Removal on Prey Populations	4. Effects on Public Safety
Alternative 1 No Federal PDM Program	PDM needs would be met by private individuals and state agencies. Take by private individuals would not be regulated or accounted for. Cumulative take of target species would likely decrease for a period until private and state PDM is compensated for loss of federal funds. Use of illegal toxicants would probably increase with possible increases in overall take of target species, but kills would likely not exceed sustainable take levels. Thus, impacts on prey populations are not likely to be significant.	PDM service to reduce rabies and other disease risks would be less available, unless state agencies receive increased funding to compensate for loss of the federal program. There would be little or no potential for adverse impacts to humans from federal use of PDM methods. However, state agency and private use of PDM methods would probably increase to present risks similar to the current program. Thus, risk of adverse impacts from PDM methods would continue to be low.
Alternative 2 Current Federally Supervised PDM Program (using Integrated Wildlife Damage Management)	Cumulative take of target species populations would remain below maximum levels sustainable by District populations, meaning adverse impacts would not be significant. Thus, impacts on prey populations would unlikely be significant.	The ability to respond to rabies suppression and other predator-related disease problems would be maintained. The risk of adverse impacts to the public from PDM methods would continue to be low.

Alternative 3 Nonlethal PDM Only	Reduced effectiveness would cause local governments and individuals to drop out of federally supervised PDM programs. PDM needs would then be met by private individuals and state agencies, and adverse impacts on target species populations would be similar to Alternative 1. Thus, impacts on prey populations would not likely be significant.	Rabies and other disease-risk situations that require local reductions of predator species would not be adequately addressed unless state agencies receive increased funding to compensate for loss of the federal program. There would be little or no potential for adverse impacts to humans from federal use of lethal PDM methods. However, state agency and private use of PDM methods would probably increase to present risks similar to the current program. Thus, risk of adverse impacts from PDM methods would continue to be low.
Alternative 4 Require Nonlethal Before Using Lethal PDM	Reduced effectiveness might cause local governments and individuals to drop out of federally supervised PDM programs (less likely than under Alternative 3). PDM needs would be met by private individuals and state agencies. Adverse impacts on target species populations would be similar to Alternative 1 but probably to a lesser degree. Thus, impacts on prey populations would not likely be significant.	Rabies and other disease-risk situations that require local reductions of predator species would not be adequately addressed in as timely a manner unless state agencies receive increased funding to compensate for loss of the federal program. Risk of adverse impacts to the public from use of lethal PDM methods would be similar to Alternative 2 (i.e., low risk).
Alternative 5 Compensation Program	Dissatisfaction with compensation would lead private individuals and perhaps state agencies to increase PDM activities. Impacts on target species populations would be similar to Alternative 1 but probably to a lesser degree. Thus, impacts on prey populations would not likely be significant.	Rabies and other disease risk situations that require local reductions of predator species would not be adequately addressed unless state agencies receive increased funding to compensate for loss of the federal program. Risk of adverse impacts to the public from use of lethal PDM methods would likely be similar to Alternatives 1, 3, and 4 (i.e., low risk).
Issue	5. Effects on Hunting	6. Humaneness
Alternative 1 No Federal PDM Program	There would be no potential for federal PDM to conflict with private sport hunting. Increased private and state agency PDM could, however, affect sport hunting to the same degree as the current program. Some sport hunters who pursue predator species might benefit by being allowed greater access to private lands that previously used ADC PDM services. Beneficial impacts on sport hunting of deer and game species that can increase with PDM would be less likely.	Pain and suffering of predators from federally used PDM methods would cease. However, private and state agency use of such methods would likely increase. Private persons are likely to use less selective methods than ADC, including illegal toxicant use, which could increase pain and suffering of nontarget species. Pain and suffering of livestock animals killed or injured by predators would likely increase, meaning that overall animal suffering would probably be greater than under the current federal program.

Alternative 2 Current Federally Supervised PDM Program (using Integrated Wildlife Damage Management)	Some sport hunters who lease hunting rights on private land where ADC conducts PDM would continue to feel that such actions conflict with their interests. Others would feel ADC PDM benefits their interests by allowing greater numbers of deer and other huntable game species that predators impact.	Some pain and suffering of individual predators and nontargets would occur, but greater selectivity by ADC would mean less deaths and pain/suffering of nontargets than under Alternative 1. Overall animal suffering would probably be lower than Alternative 1 because more livestock deaths and injuries from predation would be avoided.
Alternative 3 Nonlethal PDM Only	Potential conflicts with sport hunting would be less than the current program in some situations. However, some nonlethal methods, such as guard dogs and predator-proof fences can adversely affect deer and turkeys. Hunters of those species could be more adversely affected on some properties than under the current program. There would be less potential to increase deer and other game species numbers where predation is a limiting factor, unless state agencies increase funding to make up for the loss of federal lethal PDM activities. Overall, impacts would probably be similar to Alternative 1.	Impacts on overall animal suffering would probably be similar to Alternative 1.
Alternative 4 Require Nonlethal Before Using Lethal PDM	Impacts on sport hunting would probably be similar to Alternative 3.	Impacts on overall animal suffering would probably be similar to Alternative 1 but to a lesser degree.
Alternative 5 Compensation Program	Impacts on sport hunting would probably be similar to Alternative 1.	Impacts on overall animal suffering would probably be similar to Alternative 1.

The potential environmental impacts of implementing federal PDM involved in each of the Alternatives analyzed correspond with many of those addressed in detail in the Chapter 4 of the programmatic ADC FEIS (USDA 1994). Impacts associated with activities under consideration here are not expected to be "significant." Based on past experience, impacts of PDM activities considered in this document are very limited in nature. The addition of those impacts to others associated with past, present, and reasonably foreseeable future actions (as described in the programmatic FEIS) will not result in cumulatively significant environmental impacts. Monitoring impacts of the program on the populations of both target and nontarget species will continue.

CONSULTATION

Consultations with the following individuals and agencies were used in the development of this document:

Private Landowners

██████ predator damage management in this District is conducted on private lands. As such, each landowner or lessee must authorize access to his or her property before ██████ may implement control activity. In most cases, it is the landowner that seeks the assistance of ██████ to control predator problems. The landowner is then advised and consulted on the service ██████ can provide. Once work is started, the landowner or representative is routinely contacted to be apprised of activities and results.

████████████████████

Groups of individuals and/or county governments that belong to the Association are routinely advised of all PDM activities being conducted within their respective areas and consulted for input.

████████████████████

Members of the ██████ are routinely advised of all PDM activities being conducted within their respective areas and consulted for input.

Texas Parks and Wildlife Department

Though Parks and Wildlife has no management authority over the activities covered by this document, they are generally kept apprised of activities being conducted within the District. They were also queried for information concerning the population estimates and take of fur-bearing animals throughout the State.

U.S. Fish and Wildlife Service

The USFWS was consulted on possible effects of ADC methods upon Threatened and Endangered Species and issued a Biological Opinion (see Appendix F of the programmatic FEIS (USDA 1994)).

Texas Department of Health

The Zoonosis Control Section of the Texas Department of Health has been consulted for information about zoonotic threats to human health and safety and for information concerning rabies epizootics throughout the State.

LITERATURE CITED

- Allen, S. H., J. O. Hastings, and S. C. Kohn. 1987. Composition and stability of coyote families and territories in North Dakota. *Prairie Nat.* 19:107-114.
- Althoff, D. P. 1978. Social and spatial relationships of coyote families and neighboring coyotes. M.S. Thesis, Univ. Nebraska, Lincoln. 80pp.
- Andelt, W. F. and P. S. Gipson. 1979. Home range, activity, and daily movements of coyotes. *J. Wildl. Manage.* 43:944-951.
- Beasom, S. L. 1974. Relationships between predator removal and white-tailed deer net productivity. *J. Wildl. Manage.* 38:854-859.
- Bekoff, M., and M. C. Wells. 1982. Behavioral ecology of coyotes: social organization, rearing patterns, space use, and resource defense. *Z. Tierpsychol.* 60:281-305.
- Berryman, J. H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. *Proc. East. Wildl. Damage Control Conf.* 5:12-14.
- Bomford, M. and P. H. O'Brien. 1990. Sonic deterrents in animal damage control: a review of device tests and effectiveness. *Wildl. Soc. Bull.* 18:411-422.
- Camenzind, F. J. 1978. Behavioral ecology of coyotes on the National Elk Refuge, Jackson, Wyoming. pp. 267-294 in M. Bekoff, ed. *Coyotes: Biology, behavior and management.* Academic Press, New York.
- Chitty, D. 1967. The natural selection of self-regulatory behavior in animal populations. *Proc. Ecol. Soc. Australia.* 2:51-78.
- Clark, F. W. 1972. Influence of jackrabbit density on coyote population change. *J. Wildl. Manage.* 36:343-356.
- Clark, K. A., and P. J. Wilson. 1995. The coyote's role in a rabies epizootic. In (Proceedings) *Coyotes in the Southwest: A Compendium of our Knowledge.* December 1995. *Tex. Agric. Ext. Serv., Tex. A&M Univ.* San Angelo, TX. pp. 41-45.
- Connolly, G. E., and W. M. Longhurst. 1975. The effects of control on coyote populations. *Div. of Agric. Sci., Univ. of California Davis. Bull.* 1872. 37pp.
- _____. 1978. Predators and Predator Control pp 369-394 in Schmidt J.L. and D.L. Gilbert, eds. *Big Game of North America: Ecology and Management.* Wildlife Management Institute.
- Danner, D. A. 1976. Coyote home range, social organization, and scent post visitation. M.S. Thesis, University of Arizona, Tucson. 86pp.
- _____, and N. S. Smith. 1980. Coyote home range, movements, and relative abundance near cattle feedyard. *J. Wildl. Manage.* 44:484-487.
- Edwards, L. L. 1975. Home range of coyotes in southern Idaho. M.S. Thesis, Idaho State Univ., Moscow. 36pp.
- Fearneyhough, M. G. 1996. Director Oral Rabies Vaccination Project. Texas Dept. of Health. Austin, Tx., personal communication.

- Fritzell, E. K. 1987. Gray Fox and Island Gray Fox. pp. 408-420 in M. Novak, J. A. Baker, M.E. Obbard, B. Mallock. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150pp.
- Fuller, W. A. 1969. Changes in numbers of three species of small rodent near Great Slave Lake N.W.T. Canada, 1964-1967 and their significance for general population theory. *Ann. Zool. Fennici*. 6:113-144.
- Gese, E. M., O. J. Rongstad, and W. R. Mytton. 1988. Home range and habitat use of coyotes in southeastern Colorado. *J. Wildl. Manage.* 52:640-646.
- Guthery, F. S., and S. L. Beasom. 1977. Responses of game and nongame wildlife to predator control in south Texas. *J. Range Manage.* 30:404-409.
- Henke, S. E. 1992. Effect of coyote removal on the faunal community ecology of a short-grass prairie. Ph.D. Thesis., Tex. Tech Univ., Lubbock. 229pp.
- Henke, S. E. 1995. Effects of coyote control on their prey: A review. In (Proceedings) Coyotes in the Southwest: A Compendium of our Knowledge. December 1995. Tex. Agric. Ext. Serv., Tex. A&M Univ. San Angelo, TX. pp. 35-40.
- Keith, L. B. 1974. Some features of population dynamics in mammals. *Int. Cong. Game Biol.* 11:17-59.
- Knowlton, F. F. 1964. Aspects of coyote predation in South Texas with special reference to white-tailed deer. Ph.D.. Thesis, Purdue Univ. Lafayette. 147pp.
- _____. 1972. Preliminary interpretation of coyote population mechanics with some management implications. *J. Wildl. Manage.* 36:369-382.
- Leopold, A. S. 1933. *Game Management*. Charles Scribner & Sons, NY, NY. 481pp.
- Messier, F. and C. Barrette. 1982. The social system of the coyote (*Canis latrans*) in a forested habitat. *Can. J. Zool.* 60:1743-1753.
- Myers, J. and C. J. Krebs. 1971. Genetic, behavioral, and reproductive attributes of dispersing field voles *Microtus pennsylvanicus* and *Microtus ochrogaster*. *Ecol.. Monogr.* 41:53-78.
- NASS (National Agricultural Statistics Service). 1995. Sheep and goat predator loss. U.S.D.A., N.A.S.S., Washington, D.C. 16pp.
- Nunley, G. L. 1977. The effects of coyote control operations on nontarget species in New Mexico. *Great Plains Wildl. Damage Workshop*. 3:88-110.
- _____. 1995a. Sheep and goat losses in relation to coyote damage management in Texas. In (Proceedings) Coyotes in the Southwest: A Compendium of our Knowledge. December 1995. Tex. Agric.. Ext. Serv., Tex. A&M Univ. San Angelo, TX. pp. 114-123
- _____. 1995b. The reestablishment of the coyote in the _____ of Texas. In (Proceedings) Coyotes in the Southwest: A Compendium of our Knowledge. December 1995. Tex. Agric.. Ext. Serv., Tex. A&M Univ. San Angelo, TX. pp. 55-64
- Ozoga, J. J., and E. M. Harger. 1966. Winter activities and feeding habits of northern Michigan coyotes. *J. Wildl. Manage.* 30:809-818.

- Pearson, E. W. and M. Caroline. 1981. Predator control in relation to livestock losses in Central Texas. *J. Range Manage.* 34:435-441.
- Pitelka, F. A. 1957. Some characteristics of microtine cycles in the Arctic. *Oregon State College, Biol. Colloquium Proc.* 18:73-88.
- Pyrah, D. 1984. Social distribution and population estimates of coyotes in north-central Montana. *J. Wildl. Manage.* 48:679-690.
- Robinson, W. B. 1961. Population changes of carnivores in some coyote-controlled areas. *J. Mamm.* 42:510-515.
- Rollins, D. 1993. Statewide attitude survey on feral hogs in Texas. *Proc. of a Conf. Feral Swine: A Compendium for Resource Managers. Tex. Agric.. Ext. Serv., Tex. A&M Univ.* pp. 1-8.
- Schmidly, D. J. 1988. The furbearers of Texas. *Texas Parks and Wildl. Bull. No. 111. Texas Parks and Wildl. Austin, Tx.* 55pp.
- Shelton, M. and J. Klindt. 1974. Interrelationship of coyote density and certain livestock and game species in Texas. *Texas A&M Univ. Agr. Exp. Sta. MP-1148:* 12pp.
- Stevens, R. L. 1996. The feral hog in Oklahoma. Samuel Roberts Noble Foundation. Ardmore, Ok. 20pp.
- Stoddart, L. C. 1984. Relationships between prey base fluctuations and coyote depredation on sheep on the Idaho National Engineering Laboratory (INEL), 1979-1982. Unpublished Research Work Unit Report. Denver Wildl. Res. Cent. 16pp.
- TASS (Texas Agricultural Statistics Service). 1996. Texas agricultural statistics 1995. U.S.D.A., Texas Dept. Of Agric., Austin, Tx. 158pp.
- Taylor, R. 1991. The feral hog in Texas. Federal Aid Report Series No. 28. Texas Parks and Wildl. Dept. Austin, Tx. 20pp.
- _____. 1993. History and distribution of feral hogs in Texas. *Proc. of a Conf. Feral Swine: A Compendium for Resource Managers. Tex. Agric.. Ext. Serv., Tex. A&M Univ.* pp. 17-27.
- Teer, J. G., D. L. Drawe, T. L. Blankenship, W. F. Andelt, R. S. Cook, J. Kie, F. F. Knowlton, and M. White. 1991. Deer and coyotes: The Welder Experiments. *Trans. N. A. Wildl. Nat. Res. Conf.* 56:550-560.
- TPWD (Texas Parks and Wildlife Department). 1993. Small game research and surveys: job No.9: review of furbearer population and habitat base. Federal Aid Project No. W-126-R-2. 37pp.
- _____. 1996. Small game research and surveys: project No.11: fur-bearing animal regulations / evaluation of annual fur harvest. Federal Aid Grant No. W-126-R-4. 14pp.
- _____. 1996. Wildlife research and surveys: project No.17: bobcat status. Federal Aid Grant No. W-125-R-7. 16pp.
- Timm, R. M., and R. H. Schmidt. 1989. Management problems encountered with livestock guarding dogs on the University of California, Hopland Field Station. *Proc. Great Plains Wildl. Damage Cont. Work.* 9:54-58.

- Todd, A. W., and L. B. Keith. 1976. Responses of coyotes to winter reductions in agricultural carrion. Alberta Recreation, Parks Wildl., Wildl. Tech. Bull. 5. 32pp.
- USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC). 1994. Final Environmental Impact Statement. USDA-APHIS-ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737-1234.
- USDI (U.S. Department of the Interior), Fish and Wildlife Service. 1978. Predator damage in the West: a study of coyote management alternatives. Washington, D. C. 168pp.
-
- _____, 1979. Mammalian predator damage management for livestock protection in the Western United States. Final Environmental Impact Statement. Washington, D.C. 789pp.
- Wildlife Society, The, 1990. Conservation Policies of the Wildlife Society. The Wildl. Soc., Wash., D.C. 20pp.
- Wade, D. A. 1982. Impacts, incidence and control of predation on livestock in the United States, with particular reference to predation by coyotes. Council for Agricultural Science and Technology (CAST) Spec. Publ. No. 10. 250 Memorial Union, Ames, IA 50011. 20pp.
- _____, and J. E. Bowns. 1982. Procedures for evaluating predation on livestock and wildlife. Texas Agri. Ext. Serv. and TX Agri. Exp. Sta. Texas A&M Univ. in coop. with USDI-FWS (Fish and Wildl. Serv.) Pub. B-1429. 42pp.
- Wagner, F. H. and L. C. Stoddart. 1972. Influence of coyote predation on black-tailed jackrabbit populations in Utah. J. Wildl. Manage. 36:329-342.
- Windberg, L. A. and F. F. Knowlton. 1988. Management implications of coyote spacing patterns in southern Texas. J. Wildl. Manage. 52:632-640.

FINDING OF NO SIGNIFICANT IMPACT

Based on the foregoing, I have determined that there will not be a significant impact, individually or cumulatively, on the quality of the human environment because of predator damage management activities conducted in the Canyon District of the [REDACTED], and that the actions do not constitute a major federal action.

Individual predator damage management activities are normally categorically excluded and I have found nothing in the present circumstances to warrant an exception to that classification. The effects of predator control activities contemplated in this document, when added to the other past, present, and reasonably foreseeable future actions, will not significantly affect the quality of the human environment. This determination takes into consideration the following factors:

Based on the analysis documented in the environmental assessment for the proposed actions to be conducted in the District, the impacts of the predator management program will not have significant effects on the human environment.

The proposed action's effects on public health and safety would be minimal. No human accident associated with APHIS-ADC predator control is known to have occurred in the area or District.

There are no unique characteristics such as park lands, prime farm lands, wetlands, wild and scenic areas, or ecologically critical areas that would be significantly affected.

Mitigation measures adopted as part of the proposed action combined with standard operating procedures of ADC minimize risks to the public, and would prevent adverse effects on the human environment and reduce uncertainty and risks.

The number of animals taken (both target and nontarget) by APHIS-ADC annually in the District is small in comparison to the area's total estimated population. Effects on wildlife or wildlife habitats would be minimal.

There would not be significant cumulative effects from this project and other actions implemented or planned within the area.

The evaluation that assessed the effects of the proposal upon T&E species determined that no significant adverse effects are likely to occur on these species. Consultation with the Fish and Wildlife Service has taken place concerning T&E species for which there is a potential for adverse impacts and mitigation measures to avoid adverse impacts will be implemented.

This action would be in compliance with federal, state, and local laws or requirements for predator control and environmental protection.

DECISION

I have carefully considered this matter. Individual predator control actions that may take place in the District are normally categorically excluded from the need to prepare NEPA documentation. I have determined that taking action consistent with the second alternative provides the best chance of minimizing losses of resources to be protected in the area and of allowing the program to meet its responsibilities, while not significantly affecting the quality of the human environment. By this decision, I am directing the Canyon ADC District to implement Alternative 2 and to abide by the mitigation measures established as standard operating procedures in the ADC Directives.

The decision to implement Alternative 2 will become effective 30 days after publication of legal notice in the Dallas Morning News, Houston Chronicle, San Antonio Express-News, El Paso Times, Corpus Christie Caller Times, San Angelo Standard Times, Odessa American, Amarillo Daily News, and Abilene Reporter - News.

/s/

3/27/97

Michael V. Worthen
Western Regional Director
USDA-APHIS-ADC

Date